scribed polygon we may wish to use.' The example in question refers to a problem, to inscribe in a circle a regular polygon of any given number of sides.

FLORIAN CAJORI.

COLORADO COLLEGE,
COLORADO SPRINGS, March 2, '97.

SCIENTIFIC LITERATURE.

Microscopic Researches on the Formative Property of Glycogen. Part I., Physiological. By CHARLES CREIGHTON, M.D., Formerly Demonstrator of Anatomy at Cambridge. London, Adam and Charles Black. 1896. With five Colored Plates. Pp. 152.

Dr. Creighton's work, as stated in the preface to the present volume, has been directed especially to the problem of glycogen in the formative processes of disease, but it was found necessary to turn aside at numerous points in search of a physiological basis or paradigm, and as a result we have the present volume, dealing mainly with the bearing of glycogen on normal growth. Emphasis is laid upon the fact that the glycogen of animal tissues is not destined solely for conversion into sugar, but that in embryonic formations, as well as in pathological new growths, glycogen presents itself in its tissue-making, not its sugar-yielding character. Dr. Creighton's microscopic studies lead him toward the somewhat broad generalization "that the formative property of glycogen is analogous to or parallel with that of hæmoglobin; * * * that glycogen plays the part of a carrier to the tissues; that it contributes somewhat to the building up without losing its own molecular identity; that it is present at the formation of tissues and employed therein without becoming part of them, and that it acts thus, in some cases as the precursor or deputy of hæmoglobin, and until such time as the vascularity of the part is sufficiently advanced; in other cases as the substitute of hæmoglobin from first to last—in those tissues which are built up in whole or in part without direct access of blood."

The observations which lead to this somewhat startling view are made upon tissues, organs or whole embryos, usually fixed in potassium bichromate and hardened in absolute alcohol, the presence or absence of glycogen being determined in the sections of tissue by the usual method of treatment with a weak solution of iodine in potassium iodide. Attention is called to the fact that methyl-violet, contrary to the view frequently held, also gives a distinctive reaction with glycogen, the dye picking out the spots of glycogen from all other parts of the section as distinctively as iodine itself. This method, however, possesses no practical advantages over the iodine method.

Dr. Creighton has studied especially the relation of glycogen to the growth of the bronchial tree and of the choroid plexuses; its relation to the formation of the renal tubules and the development of the intestinal mucous membranes; its distribution in fœtal hoof, nail and hair, and in the developing and functional striated muscular fibre; its relation to the enamelling and cementing of teeth; its presence in cartilage and in the developmental and other immature secretions of the mammary glands, etc. As noted by many previous observers, glycogen is found to be especially prominent in these young embryonic tissues, especially at the centers or points of rapid growth, and at a time in fœtal life when the vascularity of the part is limited or not even established. The point, however, upon which most stress is laid is that glycogen is the dynamic principle in the developing tissue; in epithelial cells, for example, as in the formation of the renal tubules, the glycogen being the precursor of hæmoglobin as a formative agent. Thus, in the tubular formation within the kidney the advancing and differentiating epithelium is supposed to depend mainly, if not solely, upon resources contained within itself, *i. e.*, the glycogen, pending the complete establishment of vascularity, when the glycogen disappears. Similarly, in the muscular tissue of active or mature life, glycogen, like the hæmoglobin, is looked upon as a reserve store for emergencies. Although not essential to the activity of the muscle, it may, perhaps, says Creighton, take the place of the circulating blood in one way as the store or reserve of hæmoglobin does in another, or possibly there may be muscles in which the reserve is chiefly hæmoglobin, and others in which the reserve is mainly glycogen.

The physiologist has no hesitancy whatever

in accepting the view that glycogen is a reserve material of primary importance in the growth and development of new tissues, but it may well be considered whether the theory formulated by Barfurth, that the glycogen so abundant in new growths is a bye-product resulting from the cleavage of complex proteids, ready to be again utilized or stored up as reserve material as occasion demands, is not more consistent with present knowledge than the assumption that glycogen contributes somewhat to the building up of the tissues 'without losing its own molecular identity,' or that it is employed in the growth and development of the tissues without becoming part of them. The very nature of glycogen—certainly, as we ordinarily use the term—is opposed to the stability assumed in the preceding quotation. Far more plausible is the assumption that glycogen is a prominent product of metabolic activity, and as such may be widely formed in all developing tissues, while in the absence of circulating blood, which precludes its immediate removal, it may accumulate for a time in the growing tissues, doubtless being used again in the construction of fresh protoplasm. Indeed, it is so readily decomposable that it naturally constitutes a valuable pabulum for the nutrition or growth and development of fresh tissue. In this sense we can readily conceive of its importance, both as a measure of some forms of metabolic activity and as an aid to new growth, but wholly as a chemical substance which, like other kindred carbohydrates, can be utilized by the living cells which are of necessity the active agents in all growth. But Dr. Creighton, if we understand him aright, attributes to the glycogen of embryonic tissues a kind of intangible power which makes it the forerunner and pioneer of new growths, without loss of its own molecular identity and without becoming an integral part of the tissues.

Thus, in considering the glycogen so noticeable in primordial cartilage it is stated that "one function of the glycogen of cartilage may be guessed to be the separating out of calcareous salts from the protoplasm in such wise that they become visible in the form of granules or vesicular drops. Of course, by far the most of the calcareous matter of bones must come to them direct from the blood; but there is a period of development, the period of transition from cartilaginous moulds, at which lime salts are deposited independently of the blood and in some unknown manner by the agency of glycogen. Assuming that to be a real office of glycogen within the cells of cartilage, it need not exhaust its functions. The diffusion of glycogen through the cartilage-protoplast appears to impart to it a certain mobility or dynamic property, whereby cavities are hollowed out in the matrix and the partitions absorbed in aid of the formation of the central space which the blood-vessels enter and possess. Even when all trace of cartilaginous structure is lost, it appears probable that some of its protoplasm, still occupied by glycogen, is utilized in the form of ostoclasts for the further modelling of the medullary canal or the cancellous tissue. These various uses of glycogen, or purposes to which it may be put, are consistent with the view of it as an intra-cellular or parenchymatous medium, doing duty for a time, or in occasional circumstances, in place of the great internal medium, namely, the blood itself." This somewhat lengthy quotation is a good illustration of the character of the activity or dynamic power which Creighton constantly attributes to the glycogen present in embryonic tissues. To the unbiased reader, however, it would seem that such conclusions are hardly warranted, although it is possible that, in the pathological part to follow the present volume, additional facts will be presented which may tend to strengthen the author's peculiar views. Glycogen may well be considered in the above tissue as a pabulum, which, like the blood itself, furnishes material necessary for the growth and activity of the developing cells, but we fail to see why it should be necessary to attribute to the glycogen a special formative power so radically different from that heretofore attributed to carbohydrate matter in general; a formative power which raises the intra-cellular glycogen to the plane of living protoplasm itself. Its presence in the protoplasm may give to the latter increased activity, may indeed endow it with peculiar and exceptional power for the time being, but it seems far more consistent to consider that the true formative power resides

in the cell-cytoplasm and karyoplasm rather than in the glycogen as a substance by itself. It seems to the writer that the physiologist must demand very conclusive evidence before he can accept the view that "glycogen plays the part of a carrier to the tissues; that it contributes somewhat to the building up without losing its own molecular identity; that it is present at the formation of tissues and employed therein without becoming part of them."

In conclusion, it must be stated that the volume contains a record of most careful observations and that it is replete with interesting and important facts bearing upon the distribution of glycogen in embryonic tissues. Further, due weight must be given to Dr. Creighton's conclusions, although, as already stated, it appears to the writer that physiologists will have some difficulty in accepting them in their entirety.

R. H. CHITTENDEN.

YALE UNIVERSITY.

Analytic keys to the genera and species of North American Mosses. By C. R. BARNES. Revised and extended by F. D. HEALD, with the cooperation of the author. Bull. Univ. Wis. Sci. ser. I., 5, pp. 157–368, 1897.

This bulletin is the 3d edition of analytical keys of mosses published by the author. The first edition, published in 1886, included only the genera recognized in Lesquereux and James' Manual. To this was added in 1890 keys to the species, including descriptions of those published since the issue of the Manual. During the past decade there has been great activity in the study of North American mosses, which is shown in the description of 603 species and varieties since the publication of the Manual and up to January 1, 1896. The present bulletin includes besides the analytical keys descriptive of these 603 species and varieties as an appendix.

As a basis for the nomenclature used in the work the author has followed Renauld and Cardot's *Musci Americæ Septentrionalis*, preferring to do this rather than make new combinations which would necessitate the citation of the 'Analytical Keys' in future taxonomic work. The former keys have been very useful to bryologists in this country, and students of the mosses have been further placed in debt to the author by this comprehensive revision of the work.

GEO. F. ATKINSON.

CORNELL UNIVERSITY.

SCIENTIFIC JOURNALS.

JOURNAL OF GEOLOGY, FEBRUARY–MARCH, 1897.

Professor Geikie's Classification of the North European Glacial Deposits: By K. KEILHACK. The classification proposed in this *Journal* by Professor James Geikie, in which six glacial epochs separated by five interglacial epochs are recognized, is criticised. In its place is offered an unofficial announcement of the results of the detailed mapping carried on by the Royal Prussian Geological Survey.

The Average Specific Gravity of Meteorites: By O. C. FARRINGTON. Account is taken of both the weight and the specific gravity of 142 specimens which give an average of 3.69.

Drift Phenomena in the Vicinity of Devil's Lake and Baraboo, Wisconsin: By R. D. SALISBURY and W. W. ATWOOD. The region studied is on the eastern edge of the Driftless Area where the Wisconsin ice pushed out over certain high quartzite ridges. The rough topography (900–1600 A. D.) lead to certain exceptional phenomena in connection with the drift border. The ice mounted the high ridges but halted on the summits in a most peculiar manner. The edge of the ice is marked by a moraine of the character known as 'Endmoräne' by the Germans. Where it crossed the 'Devil's Nose' the slope of the upper surface of the edge of the ice was measured and found to be about 320 feet per mile. This measurement has the exceptional interest of being the first recorded measurement at the extreme margin of the ice. Skillett creek was diverted by the filling up of its lower course by the overwash; the Baraboo was dammed and a temporary lake was formed, and on the east quartzite bluff a smaller lake was formed which finally became extinct by the complete filling up of its basin.

Comparison of the Carboniferous and Permian Formation of Nebraska and Kansas, II.: By CHARLES S. PROSSER. A continuation of the author's paper in the preceding number of the *Journal*. The Nebraska City section is quite